

## INDIAN DRAGONFLIES

BY

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Part XXXII

(With four plates)

(Continued from page 59 of Vol. XXXIII)

Subfamily—EPALLAGINAE—(continued)

Genus—ALLOPHAEA gen. nov.

*Euphaea* Ramp. (pars), Ins. Nevrop. p. 228 (1842); Selys, Syn. Cal. p. 50 (1853); Id. Mon. Cal. p. 167 (1854); Walk. List Neur. Ins. B M. iv, p. 637 (1853); Will. Proc. U.S. Nat. Mus., vol. xxviii, p. 169 (1904).

*Pseudophaea* Kirby (pars), Cat. Odon. p. 109 (1890).

Characters as for the subfamily; wings of male hyaline, saffronated broadly, hyaline and colourless in the female; apices rather pointed; hindwings not markedly broader than the fore and not broader than the same wing in the female; petiolation very short, almost absent; *Rii* not in contact with *R+M*; node situated nearer base of wing than apex, about midway between base and pterostigma; discoidal cell traversed once or twice, short, about one-third the length of median space; arc slightly bent; sectors of arc arising from middle of arc and slightly separated at origin; usually 3 cubital nervures to all wings; about 4 intercalated sectors between *IA* and hinder border of wing, *IA* never forked; 4 or more sectors between *IA* and *Ciii*; origin of *Riii* usually very slightly distad of subnode or in continuation with it; no basal incomplete-antennodal nervure in subcostal space; pterostigma present in all wings of both sexes, long, narrow.

Thorax robust but short; legs as for subfamily; abdomen extending beyond tips of wings in the male, sometimes markedly so, but of the same length in the female; superior anal appendages homogeneous, simple, forcipate, longer than segment 10; the latter rounded or arched apicad and with a prominent keel or carinal spine on its middorsum; vulvar scale robust, short, not extending to end of abdomen.

Genotype—*ochracea* Selys.

*Distribution.* Indo-malay and Indo-china, Assam and Burma.

*Allophaea ochracea* (Selys.) (1859).

*Euphaea ochracea* Selys, Bull. Acad. Belg. (2), vii, p. 443 (1859); Id. Ann. Mus. Civ. Genov. (2), x, pp. 56-57 (1891); Laid. Proc. Zool. Soc. Lond. (i), p. 87 (1902); Will. Proc. U.S. Nat. Mus., vol. xxviii, pp. 181-82 (1904); Mart. *Mission Pavié, Nevrop.* (sep), p. 15 (1904).

*Pseudophaea ochracea* Kirby, Cat. Odon. p. 109 (1890); Laid. Rec. Ind. Mus. vol. xiii, pp. 32-33 (1917).

Male. Abdomen 33-35 mm. Forewing 33-35 mm. Hindwing 30-33 mm. Head black unmarked, genæ, bases of mandibles and labrum glossy black, the rest matt black.

Prothorax matt black with the hinder border of posterior lobe narrowly, a small spot below it on each side, and a large semilunar lateral spot bright ochreous.

Thorax matt black marked with a series of 4 pairs of stripes on each side bright ochreous, the first pair antehumeral, confluent above and nearly so

below; the second lying between the humeral and first lateral sutures, confluent above, and the posterior of the pair with the anterior of the third pair; the third and fourth pairs lying between the lateral sutures and on metepimeron respectively, much broader and more diffuse than the two anterior pairs and, in fact, covering the greater part of the mesepimeron and metepimeron; the trochanters and a small spot on each side in the antearlar sinus ochreous.

Legs black unmarked.

Wings hyaline, both fore and hind broadly saffronated or amber-tinted, the fore for rather more than their basal halves, the hind as far as the pterostigma, which is black, a little oblique at its proximal end and covers about 6 cells; discoidal cell of forewing traversed once, that of hindwing once or twice; 3 cubital nervures in all wings; nodal index,—about 30 antenodal nervures and 35 postnodals in forewings, and about 26 antenodal nervures and 35 postnodals in the hind. The hindwing slightly broader and shorter than the fore; reticulation at apices very fine.

Abdomen black marked with ochreous as follows,—a diffuse lateral stripe extending from segment 1, where it is very broad, to segment 5 or 6, brighter basal rings on segments 3 to 5 or 6, and an apical ring on segment 1; the dorsal carina finely ochreous from segment 2 to 4 or 6. In subadults the general colouring of abdomen dark ochreous clouded with black; in adults, segments 6 or 7 to the end black, unmarked.

Anal appendages black; superiors slightly longer than segment 10, separated at base, parallel, compressed laterally and with blunt apices, which, as seen from above, curl slightly in towards one another; inferiors very short, conical pointed.

Genitalia; hamules projecting as two robust conical sharp teeth; lobe black, large, scrotal-shaped.

Female. Abdomen 29-30 mm. Hindwing 28-29 mm.

Differs from the male by the much broader and more extensive yellow markings, by its more robust and stockier build, by its shorter abdomen and by its wings being only palely and diffusely saffronated in basal portions, the colouring being finally lost near the node in both fore- and hind-wings.

Head black marked with yellow as follows,—the whole of labium except extreme tips of lobes, the whole of labrum except the anterior border finely and a small median virgule springing from base, the mandibles, the cheeks broadly, a broad stripe across frons and a small oblique oval spot on each side of vertex with inner ends resting on the posterior ocelli.

Prothorax and thorax as for male but the markings more extensive and the whole of mesepimeron and metepimeron except their centres, which are clouded with black.

Legs brown, femora obscurely yellow on outer side and thinly pulverulent, as is also the underside of thorax and first two segments of abdomen.

Wings hyaline, coloured as detailed above; pterostigma bright ochreous between black nervures, pointed inwardly, covering 7 to 8 nervures; nodal index lower than in the male,—only about 20 antenodal nervures and 28 postnodals in forewings, about 20 antenodals and 25 postnodals in the hind; discoidal cell as in male; 3 or 4 cubital nervures in hindwings; *Riii* arising a little distad of subnode in all wings.

Abdomen black marked with yellow as follows,—a broad lateral stripe extending from segment 1 to 7, constricted subapically and finely divided by the jugal suture near base of segments; the middorsal carina finely from segment 1 to 5, obscurely so on 6 and 7, and often on 8, conspicuously so on segment 9 and less so on 10; a small rounded lateral spot on segment 8, a subquadrate one on each side of the apical two-thirds of 9, and the apical border of 10 narrowly. Anal appendages black, small, conical, pointed acutely.

Vulvar scale extending to end of segment 9, spotted with yellow.

*Distribution.* Assam, Burma, Malacca, Siam and Annam. The type in the Selysian collection comes from Mt. Ophir, Malacca. Khow Sai Dow Mt., 1,000 ft., Trong, Siam, Jan.-Feb. (Williamson); Gokteik, Upper Burma, June, coll. Col. F. Wall, i.m.s.; Shillong, Assam, June, coll. T Bainbridge Fletcher, and Cachar. August, coll. Mr. Antrim.

There is no difficulty in distinguishing this species, except from *brunnea*, by its hyaline wings, saffronated but without opaque areas. It has a wide distribution extending from Assam to furthest French Indo-china, and taken at altitudes from 1,000 to 5,000 ft. Larva unknown.

*Allophaea brunnea* (Selys) (1879).

*Euphaea brunnea* Selys, Bull. Acad. Belg. (2), xlvi, p. 374 (1879); Id. Ann. Mus. Civ. Genov. (2), x (xxx), p. 37 (1879).

*Pseudophaea brunnea* Kirby, Cat. Odon. p. 109 (1890); Mart. *Mission Pavie, Nevrop.* (sep.), p. 15 (1904); Laid. Rec. Ind. Mus., vol. xiii, p. 33 (1917).

Male. Abdomen 32-38 mm. Forewing 30-32 mm. Hindwing 28-31 mm. It is extremely doubtful whether this insect is distinct from the former; Selys himself expresses such a doubt. In the 4th Additions to the Synopsis des Calopterygines he states that it is probably related to *ochracea* but is much larger. At the same time the measurements actually given by him are similar to those he gives for *ochracea*! Again in his *Odonates des Birmanie* he states, apropos of the latter, that,—‘It is possible that *E. brunnea* Selys (4th Add. au Syn. 64th) from Khasia Hills, which I described from a single male, may not be distinct from *ochracea*.’

I have not seen the type of *ochracea* but I have specimens of what probably is that insect from Siam, Burma and Assam and apart from size which varies considerably, even in the same locality, I can find no differences to separate them into two distinct species.

In addition to size, Selys gives another character, that of the colour of the wings which are said to be of a darker brown. Here again we find variability.

In a single specimen which I have from Shillong, Assam, collected by Mr. Bainbrigge Fletcher, the size is greater than in other specimens that I have seen from the same and other localities,—abdomen 38 mm. and hindwing 30 mm. and the saffronated parts of the wings are clouded with dark brown along the costa in the forewing and in the outer and posterior part in the hind. Another specimen from Kalaw, Burma, has the same dark colouring but its size is remarkably small. For the present and until more material is available, this question must remain open.

*Distribution.* Khasia Hills, Assam. Female unknown. Markings identical to those of *ochracea* which is also taken in the same hills. It must be noted that, at the time the two species were described, they had been reported from Malacca and Assam only, two widely separated areas, since which, *ochracea* has been found linking up the two in Burma.

#### Genus—PSEUDOPHAEA Kirby (1890)

*Euphaea* Ramb., Ins. Nevrop. p. 228 (1842),—Selys, Syn. Cal. p. 50 (1853),—Id. Mon. Cal. p. 167 (1854),—Walk. List. Neur. Ins. B. M. iv. p. 637 (1853),—Will. Proc. U. S. Nat. Mus. vol. xxviii, p. 169 (1904).

*Pseudophaea* Kirby, Cat. Odon. p. 109 (1890),—Laid. Rec. Ind. Mus. vol. xiii, p. 32 (1917).

Characters as for subfamily; wings of male marked with opaque black, often metallic blue, green or purple; hyaline in the female; apices pointed in the forewing, inclining to be rounded in the hind, the hind markedly broader than the fore in the male and considerably broader than in the female; petiolation absent or nearly so; *Rii* not in contact with  $R + M$ ; node situated nearer base of wing than apex and slightly nearer base than pterostigma; discoidal cell traversed once only, short, about one third as long as median space; arc nearly straight; sectors of arc separated at origin and arising from centre of arc; usually only 2 cubital nervures in all wings; 4 long and numerous short intercalated sectors between *IA* and hinder border of wing; 2 long and 2 short intercalated sectors between *IA* and *Cuii*; origin of *Riii* proximal of the subnode in all wings; no basal incomplete antenodal nervures in subcostal space; pterostigma present in all wings of both sexes, long and narrow.

Thorax robust, rather short; legs as for subfamily; abdomen extending well beyond apices of hindwings in the male, of the same length as abdomen in the female; anal appendages very homogeneous, simple, forcipate, longer than segment 10, the latter with a marked middorsal keel or spine, its hinder border arched or ending in the dorsal spine; vulvar scale robust, short, not extending beyond end of abdomen.

Genotype,—*variegata* Ramb.

*Distribution.* Ceylon, Western Ghats of India, Burmah, Indo-malay, Indo-china, Java, Sumatra, Borneo, Amboina and Philippines. (I have cited Western India, as *splendens* has been doubtfully reported from there.)

***Pseudophaea splendens* (Selys) (1853)**

*Euphaea splendens* Selys, Syn. Cal. p. 52 (1853),—Id. Mon. Cal. p. 178 (1854),—Id. Bull. Acad. Belg. (2), xxxv, p. 485 (1873),—Walk. List. Neur. Ins. B. M. p. 638 (1853).

*Pseudophaea splendens* Kirby, Cat. Odon. p. 110 (1890),—Id. Journ. Linn. Soc. Lond. Zool. xxiv, p. 559 (1893),—Laid. Rec. Ind. Mus. vol. xiii. p. 32 (1917),—Id. Spolia Zeylanica, vol. xii, pp. 356–57 (1924).

*Pseudophaea carissima* Kirby, l.c. pl. xlii, fig. 4 (1893).

Male. Abdomen 35 to 41 mm. Forewing 31–36 mm. Hindwing 28–33 mm.

Head: labium blackish brown; labrum, cheeks and clypeus glossy black; rest of head deep velvety matt black.

Prothorax and thorax matt black, the latter with the first lateral suture and anterior border of metepimeron obscurely ochreous. In teneral, the thoracic markings similar to those of the female.

Legs black, femora dark reddish-brown internally.

Wings opaque black, forewings with the base as far as midway to node hyaline but tinted with brown and with the nervures in the outer part of this area, bordered and clouded with opaque brownish black; apices of same wings paler from the level of proximal end of pterostigma; hindwings, except for a small basal area anterior to 1A, opaque, to extreme apices, and darker than forewings on the upper surface, an area from base as far distad as halfway between node and apex of wings, brilliant metallic green or peacock blue according from which angle viewed, the outer border of this area running straight from costal to hinder border of wing but the basal limit not including that hyaline area already mentioned above; pterostigma black, very long, acutely pointed at its proximal end, a little broadened at its centre, covering about 12–14 cells; beneath hindwing, the metallic area has a deep glossy steely blue reflex. The membrane of wings markedly pleated; about 30 antenodal nervures in forewings and about 40 postnodals, about 22 antenodals and 30 postnodals in the hindwings; only 2 cubital nervures in all wings; discoidal cell traversed but once in all wings.

Abdomen black with an obscure lateral stripe of ochreous on segments 1 and 2.

Anal appendages black, spatulate, blunt at apex, hollowed out within, parallel, but the apices curled very slightly in. Seen from above triangular in outline, with broad base and pointed apex. Inferior appendages very short, conical, pointed.

Genitalia very similar to *ochracea* but the hamules a little less prominent and the lobe smaller and flatter.

*Female.* Abdomen 31–38 mm. Hindwing 29–37 mm.

Head: labium yellow with the tips and central portion of middle lobe black, the latter area pulverulent white; rest of head black as for male but with the bases of mandibles, cheeks, a small subrotundate spot just in front of each lateral ocellus, and the labrum citron yellow, the latter with its anterior border, base and a median basal triangular tongue black.

Prothorax with a large lateral boss on each side of middle lobe citron yellow.

Thorax with an antehumeral stripe not quite extending up to antealar sinus citron yellow, a small spot of the same colour on each half of the alar sinus. Laterally a thick stripe of yellow on the first lateral suture and the upper and anterior half of the metepimeron. In old specimens these lateral yellow markings and the underside of thorax pulverulent white.

Legs black, flexor surface of femora yellow and often pulverulent.

Wings hyaline, palely and evenly enfumed, brownish with a greenish tint, or in old specimens, the forewings clear and the hind only enfumed brown, with the apices for a little proximad of inner end of pterostigma dark brown. The extreme apices of forewings occasionally also enfumed. Neuration similar to that of male but occasionally only a single cubital nervure present; nodal index,—about 26–30 antenodal nervures and about 30, postnodals, 20–25 antenodals and 25 to 30 postnodals to hindwings; pterostigma dark brown between black nervures, covering about 10 cells.

Abdomen black marked with citron yellow as follows,—segment 1 broadly on the sides, segment 2 with a broadish lateral stripe sinuous in its apical half and dilated abruptly at its apical end, segments 2 to 4 with a narrow lateral stripe which is broken at the basal end so as to leave an isolated spot, segment 5 with only the basal spot.

Anal appendages half as long again as segment 10, conical and very acutely pointed at apex; vulvar scale robust, extending nearly to end of abdomen. (The male with a peculiar tuft of black stiff hairs springing from a small tubercle on each side of the ventral basal end of segment 9, the nature of which is unknown.)

*Distribution*: Confined to Ceylon, although Selys gives 'India' as one of its localities. If this is correct, it must be from the High Range Travancore, south of the Palghat Gap, where the Odonate fauna begins to take on a distinct Ceylon facies so far as at present known. I have specimens from Dyatalawa, 5,000 feet, August; Hatton, 4,000-5000 feet, May; Nalande, September and Dyraaba, September.

It is not uncommon on most of the montane streams of Ceylon and is to be found flitting slowly up and down stream or perching upon overhanging ferns above the water. When in flight, the male keeps the hindwings fully outspread, using them as planes and the forewings as propellers, so that the full beauty of the hind is displayed. It must be reckoned as one of the most beautiful insects found in Asia. The females are to be found in the neighbouring jungle, perched on prominent twigs from which they launch themselves on passing prey; rarely are they seen over their parent streams and I have never seen them in-cop or ovipositing.

Type in the Selysian collection, paratypes in most European collections and also in the Pusa, Calcutta and Bombay Museums.

*Pseudophaea masoni* (Selys) (1890).

*Euphaea masoni* Selys, Bull. Acad. Belg. (2), xlvii, p. 377 (1879).—Laid. Fascic. Malayenses (Zool), Part I, p. 194 (1903).—Mart. Mission Pavie, Nevrop. (Sep.), p. 15 (1904).—Will. Proc. U. S. Nat. Mus. xxviii, p. 182 (1904).

*Pseudophaea masoni* Kirby, Cat. Odon. p. 110, (1890).—Id. Ann. Mag. Nat. Hist. (6) xiv, p. 113 (1894).

Male. Abdomen 28-35 mm. Hindwing 24-30 mm. Forewing 26-31 mm.

Head: labium dark brown; labrum, cheeks, bases of mandibles and anteclypeus glossy black; rest of head matt velvety black and, in most specimens, an obscure reniform yellowish spot running obliquely out from each posterior ocellus.

Prothorax and thorax velvety black, the former unmarked, the latter, except in adult specimens (from Upper Burma), with the following yellowish brown markings all more or less obscure, especially in adults,—a narrow antehumeral line, a small spot on each half of alar sinus, a narrow humeral stripe, an equally narrow posthumeral complete in its upper half only; four parallel stripes on the sides, in two pairs, one on the mesepimeron and the other on the metepimeron.

Legs black.

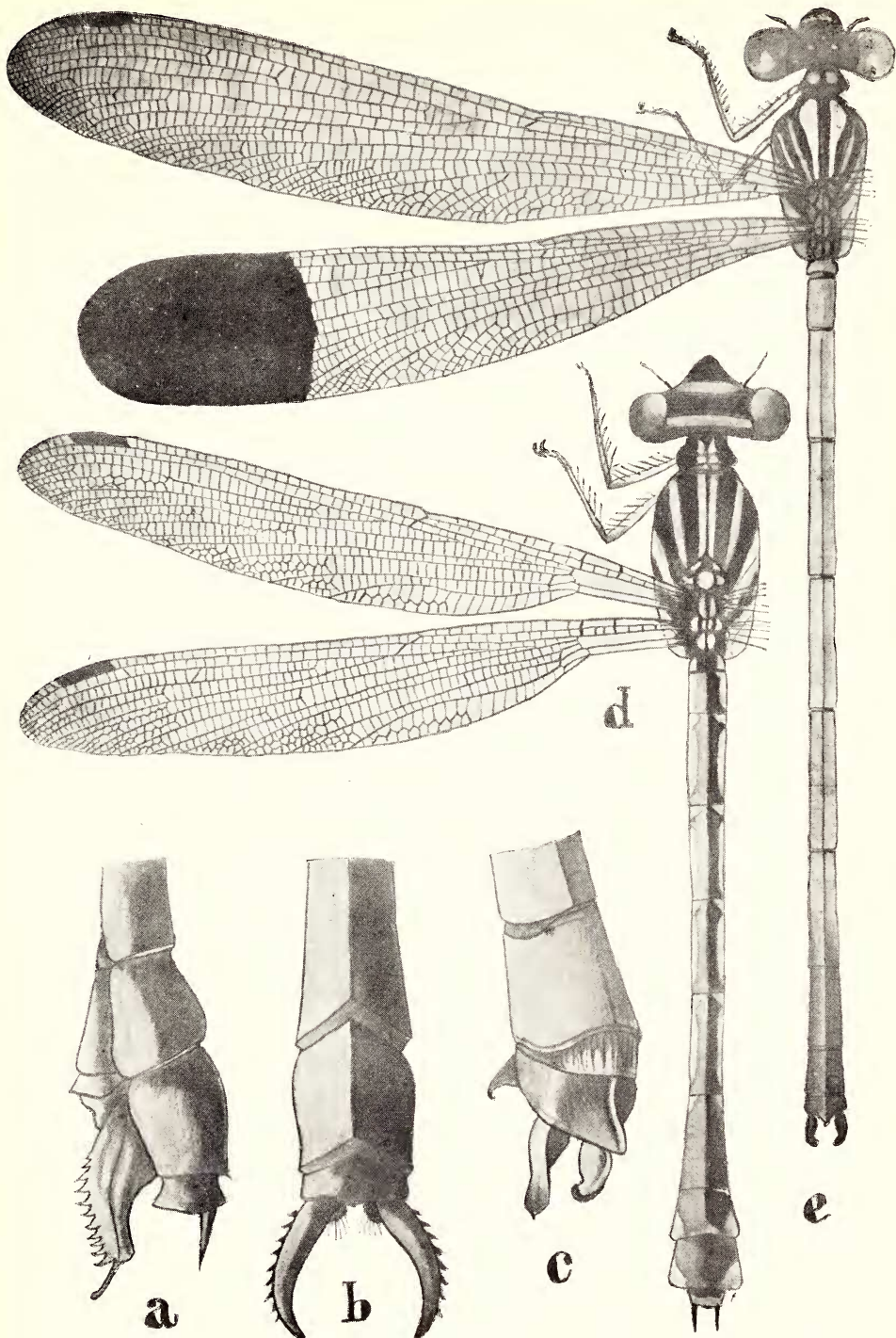
Wings opaque blackish brown, the hind with the extreme apex hyaline or occasionally hyaline as far as distal end of pterostigma and with the median space and base of subcostal space paler; forewings with the apex hyaline for a variable distance, as far as inner end of pterostigma or for 5 or more cells proximal of proximal end of pterostigma, the base of wing also hyaline but unfumed for rather more than halfway from base to node, rarely nearly as far as node, and in all cases, the subcostal space opaque as far as base, so that the hyaline area is traversed by a prominent black streak; pterostigma long, narrow, black, covers 8 to 11 cells; discoidal cells traversed once (entire in one wing of a Burmese specimen); normally 2 cubital nervures but occasionally 3; 25 to 30 antenodal nervures and 30 to 35 postnodals in forewings, 20 to 23 antenodals and 24 to 32 postnodals in the hind; the opaque areas of wings beneath steely metallic blue or bronzed.

Abdomen black, unmarked. Segment 10 with a very prominent carinal spine. Anal appendages black, superiors very similar to those of *splendens*, but more constricted at base and more expanded thereafter and with some minute spines at apex, which is curved in slightly. Inferiors very small, conical, ending in a fine point.

Genitalia very similar to *splendens*.

Female. Abdomen 33 mm. Hindwing 31 mm.

(This sex has not hitherto been described, I am indebted to the Paris Museum for the specimen from which the following description has been made.)



- (a) Terminal abdominal segments of *Philoganga montana* Selys, showing saw-like ovipositor
- (b) Terminal abdominal segments and anal appendages of *Philoganga montana* Selys, male, dorsal view.
- (c) Terminal abdominal segments and anal appendages of *Indophaea fraseri* (Laid.), left latero-dorsal view showing spine on dorsum of 10th segment and left inferior appendage.
- (d) *Philoganga montana* Selys, female.
- (e) *Indophaea fraseri* (Laid.), male.

Differing entirely as usual from the male and very similar to the female of *splendens*.

Head: labium dirty brown tipped with black; labrum citron yellow narrowly encircled with black and with a prominent median basal tongue of black, which nearly meets the anterior black border; ante- and post-clypeus black; cheeks, bases of mandibles, a very broad band traversing the frons and an elongate spot running obliquely outward from between the ocelli, all citron-yellow.

Prothorax black marked with yellow as follows,—a small subdorsal spot on each side of anterior lobe, a large lateral yellow boss on each side of middle lobe, the posterior margin of the posterior lobe narrowly and a small longitudinal medial spot above this lobe, and finally a large yellow boss on each side of the posterior lobe.

Thorax black marked with moderately narrow anthehumeral and humeral stripes, a fine posthumeral stripe broadly broken at its middle and lastly the whole of the sides and beneath, except for narrow black stripes outlining the lateral sutures.

Legs black, the proximal two thirds of hinder femora and the inner sides of middle femora yellow.

Wings long and narrow, uniformly enfumed greenish brown; pterostigma brown or dark ochreous finely framed in black, long and narrow; *Riii* arising slightly proximad of the subnode, other details of venation as given for the male.

Abdomen black marked with greenish yellow as follows,—segment 1 largely yellow but with a basal dorsal patch of black and a lateral spot of the same colour, segment 2 with its middorsal carina narrowly yellow and with a broad longitudinal lateral stripe expanded apicad; segment 3 similar but with the dorsal stripe tailing off and finally disappearing before the apical end, and with the lateral stripes expanded at both ends, segments 4 to 7 similar but without the dorsal marking and with the lateral gradually narrowing, segment 8 with a round spot on each side, 9 with a large subquadrate spot on each side, whilst 10 has a vestigial rounded spot only.

Anal appendages small, pointed, conical black. Vulvar scale yellow, not quite extending to end of abdomen.

*Distribution.* Naga Hills, Assam, in April; Gok Teik, Upper Burma, in May and Tavoy District in April; also below Maymyo, 2,500 ft, in June; Daban in Annam, 600 ft, May; Hoa Minh, Tonkin, and near Bangkok, Siam. The type in the Selysian collection comes from Tenasserim, Lower Burma. This species therefore has a very wide distribution extending from Assam to French Indo-China. Col. F. Wall, I.M.S., found it not uncommon near Maymyo, Upper Burma, and Mr. Elton Bott in Tavoy. It is subject to great variation in size like most other *Pseudophaeas*, but to a less extent, in its markings. It is one of the blackest dragonflies known and must be very conspicuous on the wing. The wing markings serve to distinguish it from others.

*Pseudophaea bocki* has been mentioned as from Burma by the late Rene Martin, but this is most certainly an error.

#### Genus INDOPHAEA gen. nov.

Characters of the subfamily; hindwings of male with apices more or less broadly opaque black, nearly up to the node in one species; forewings hyaline as also all wings of the female; forewings with apices pointed, hindwings rounded, markedly so in some species and considerably shorter than the fore; fore- and hind-wings of equal breadth, and wings of equal breadth in the sexes; petiolation distinct especially in the hindwings; *Rii* not in contact with  $R + M$ ; node situated much nearer base of wing than apex especially in forewings; discoidal cell traversed, usually once, but occasionally entire and occasionally 3 times; 2 to 5 cubital nervures, usually 3; *Riii* arising at, or slightly, or very widely distad of the subnode; discoidal cell of forewing much shorter than that of hind and less than half the length of median space; arc almost straight; sectors of arc arising from middle of arc and widely separated at origin; 3 or 4 intercalated sectors between *IA* and hinder margin of wing; *IA* never forked; several short intercalated sectors between *IA* and *Cuii*; no basal incomplete antenodal nervures in subcostal space; pterostigma present in all wings, very long and very narrow.

Thorax robust; legs as for subfamily; abdomen cylindrical, very long and attenuated, usually much longer than hindwings (Markedly so in *fraseri* but of nearly the same length in *cardinalis*) but of the same length or shorter in the female; anal appendages very homogeneous, simple, forcipate; segment 10 pointed apicad and with a very robust dorsal keel; vulvar scale robust, not extending to end of abdomen.

Genotype,—*dispar* Ramb.

*Distribution.* Western Ghats of India, Indo-malay and Borneo.

*Indophaea dispar* (Rambur) (1842).

*Euphaea dispar* Ramb. Ins. Névrolog. p. 230 (1842),—Selys, Syn. Cal. p. 51 (1853),—Id. Mon. Cal., p. 169 (1854).—Id. Bull. Acad. Belg. (2) xxxvi, p. 614 (1873),—Walk. List. Neur. Ins. B. M. iv, p. 640 (1853).

*Pseudophaea dispar* Kirby, Cat. Odon. p. 109 (1890),—Laid. Rec. Ind. Mus. vol. xiii, p. 32 (1917),—Id. *ibid.* vol. xix, pp. 25-27 (1920),—Fras. *ibid.* vol. xxiv, p. 9 (1922).—Id. *ibid.* vol. xxvi, pp. 479-480 (1924).

Male: Abdomen 39-47 mm. Hindwing 32-40 mm. Forewing 35-42 mm.

Head: labium dark reddish brown, paler at the borders of lateral lobes; labrum turquoise blue finely bordered with black and with a medio-basal tongue of black; bases of mandibles with a spot of turquoise blue; cheeks and epistome glossy black, rest of head matt black, unmarked.

Prothorax black with a large reddish ochreous boss on each side of middle lobe, a smaller reniform spot below it and the hinder border of posterior lobe the same colour.

Thorax black marked with bright reddish ochreous as follows,—ante-humeral and humeral stripes confluent as a broad loop above and narrowly separated below so as to nearly enclose a long oval spot of the ground colour, the rest, posterior to the humeral suture, which is finely black, bright reddish ochreous except for an oval spot of black between the humeral and first lateral sutures, and a small spot or beginnings of a stripe on the upper parts of the two lateral sutures. An elongate spot on each half of antealar sinus and the whole of underside of thorax bright ochreous.

Legs bright yellow except the extensor surface of femora and tibiae which are dark reddish.

Wings hyaline palely enfumed with greenish brown; apices of forewings merely tipped with blackish brown; apices of hindwings broadly black to as far proximad of pterostigma as nearly halfway from apex to node; apex of this wing rounded and only about 3 mm. shorter than forewing but about 7 mm. shorter than abdomen; pterostigma black, covering about 12 cells; 3 cubital nervures to all wings; discoidal cell traversed once; *Riii* arising 1 to 2 cells distad of the subnode; about 24 antenodal nervures and about 40 postnodals to forewings, about 20 antenodals and about 38 postnodals to hindwings (Number differs widely according to size of insect). (Discoidal cell may also be freakishly traversed or entire, thus in one specimen the cells of the hindwings are traversed twice, whilst that of the right forewing is entire and that of the left traversed once). (Occasionally a specimen will be taken with the black apex of hindwing marked by a large hyaline window.)

Abdomen bright vermilion red, the segmental joints and the entire abdomen from the apical third of segment 6 to the end black. The apical end of segment 8 with a tuft of short black hairs on its ventral surface and about 8 long stiff black hairs beneath the basal end of segment 9; segment 10 with a very prominent dorsal keel.

Anal appendages very similar to those of *masoni*, black, unguate, laterally compressed and hollowed out within, apices blunt and furnished with a few inconspicuous spines above. Inferior appendages very small conical, pointed.

Genitalia very similar to *masoni*, bright ochreous, the hamules finely bordered with black, lobe large, scrotal shaped, black.

Female. Abdomen 35-38 mm. Hindwing 34-39 mm.

Bearing a remarkable likeness to those of *splendens*, *masoni*, etc.

Head: labium dirty yellow; labrum and bases of mandibles turquoise blue, the former finely bordered with black and with a medio-basal tongue of black as in the male; anteclypeus black; postclypeus and a broad transverse band across the frons, as well as cheeks broadly bright ochre. A rounded spot of the same colour on the outer side of each hinder ocellus.



Prothorax and thorax marked similarly to the male, but yellow instead of bright reddish ochreous. The dorsal stripes are narrower, the black post-humeral spot is confluent with the black below, not entirely surrounded by brighter colour, the lateral vestigial black sutural lines are complete, although that on the first lateral suture is rather diffuse and often incomplete below. Legs as for male but more black.

Wings hyaline uniformly enfumed with greenish brown and the hind, in old specimens, with a moderately well-marked brownish black apex extending proximad slightly beyond inner end of pterostigma; venational details and pterostigma similar to male; *Riii* not quite one cell distad of the subnode; cubital nervures sometimes irregular, 2 to 4 in number and the discoidal cells sometimes traversed twice; pterostigma black, over about 12 cells; nodal index — 32.18|17-34  
— 30-18|19-31.

Abdomen black marked with bright yellow or ochreous as follows,—1st segment almost entirely greenish yellow, segments 2 to 7 with a longitudinal stripe on either side, broad on 2, narrower on the rest and becoming interrupted on segments 6 and 7, the basal end expanded and cut off from the rest by the jugal suture; segment 8 with a small quadrate apical lateral spot, segment 9 with a larger similar spot, 10 unmarked.

(Markings subject to great variation,—in a specimen from South Kanara the markings are largely obsolete, especially on the abdomen, whilst those on the thorax are cut up into parallel lines of yellow by the black, even on the sides. In other specimens there is an additional small round spot on the inner side of each posterior ocellus and the hinder border of the posterior lobe of prothorax is bright yellow as in the male. Unlike *masoni* and *slendens*, there is no dorsal yellow marking on any of the abdominal segments.)

Anal appendages small conical pointed, black. Vulvar scale robust, marked with yellowish, not extending to end of abdomen.

*Distribution.* Confined to the Western Ghats of India from South Kanara and Coorg to the Nilgiris,—Malabar Wynaad. Easily distinguished from other species by the extent of black on apices of hindwings—and by its turquoise blue labrum and mandibles. The black area of wings has a steely blue reflex, as seen in some lights or dull coppery bronze in others. The female is distinguished from other species by its turquoise blue labrum. Like all *Pseudophaea*s there is a great disparity in size of specimens from various localities, those from lower altitudes usually being of smaller size than those from higher. It occurs from 3,500 ft. to 6,000 ft. breeding in streams. Usually the males, will be found perched on twigs some feet above the water, often at a great height, especially towards nightfall when they rise to the tops of neighbouring trees.

Females are not uncommon but must be sought for in the neighbouring jungle or ridings some short distance from the streams. They are very pugnacious and I have found them devouring tenerals of their own species! Rarely are they found in cop but I have a pair, which not even death, in the cyanide bottle, was able to part, an unique exhibit showing the double act of copulation.

Type in the Rambur collection, now I believe in the Selysian collection. Paratype in the British Museum, Pusa and Indian Museums, and in most private collections, to which I have been able to present specimens. It is on the wing from the end of May to September.

#### *Indophaea cardinalis* (Fras.) (1924).

*Pseudophaea cardinalis* Fras. Rec. Ind. Mus. vol. xxvi, pp. 512-13 (1924).

Male. Abdomen 41-45 mm. Forewing 39-42 mm. Hindwing 36-40 mm.

Head: Labium dirty yellow, brown at its middle; labrum bright ochreous narrowly bordered with reddish brown and an obscure mediobasal tongue of dark brown; anteclypeus dark blackish brown; postclypeus, bases of mandibles and cheeks bright ochreous; frons broadly reddish ochreous clouded with reddish brown at its middle and with a crenulate black basal line from which spring medial and lateral short black points; four small black points also projecting into base of postclypeus; rest of head black save for basal joints of antennæ and a small round point lying slightly to the outer and fore side of posterior ocellus on each side bright ochreous. Eyes dark reddish brown; frons coated with long black hairs.

Prothorax black with a large boss on each side of the middle lobe, the hinder border of the posterior lobe save at its middle, and the sides broadly bright ochreous.

Thorax bright reddish ochreous and black, markings very similar to those of *dispar*, thus,—antehumeral and humeral narrow ochreous stripes confluent as a loop above and nearly confluent below; the humeral suture narrowly outlined in black; laterally entirely ochreous save for a long oval spot of black between the humeral and first lateral sutures and the beginnings of narrow black lines on the upper parts of the lateral sutures; beneath ochreous.

Legs entirely reddish, the tarsi dark reddish brown, spines black.

Wings relatively broader than in *dispar* and marked very similarly. Forewings hyaline, faintly enfumed and with a greenish tinge, tinted with yellow at extreme base; hindwings with apical ends black as far proximad as 4 to 8 mm. from the node, and in some, quite the outer half of wing opaque black, this part dull coppery above, dull or steely bluish-black below; pterostigma long, covers 10-12 cells, black; *Riii* arising from half to one and a half cells distad of subnode or even in continuation of the subnode; discoidal cell entire in all wings of some specimens, or traversed once in the forewings, or twice or thrice in the hind, very variable; 2 cubital nervures in forewings, 2 to 4 in the hind; 20 to 24 antenodal nervures and 38 to 47 postnodals in forewing, about 18 to 20 antenodals and 38 to 40 postnodals in the hind.

Hindwing 2 to 3 mm. shorter than forewing and markedly rounded.

Abdomen bright vermilion red as far as the basal two-thirds of segment 6 from which point it is black. Segment 10 with a very pronounced carinal spine; segments 8 and 9 with tufts of long hairs ventrad.

Anal appendages similar to those of *dispar*, as also genitalia.

Female. Abdomen 36 mm. Hindwing 37 mm.

Head: labium black; labrum coloured similarly to the male; cheeks, bases of mandibles, a broad fascia traversing the frons but slightly interrupted at its middle, and a small oval spot on the outer foreside of the posterior ocellus bright ochreous; rest of head black.

Prothorax and thorax bright yellow marked with black as in the male but the lateral stripes on the sutures complete.

Legs blackish brown, the flexor surfaces of femora obscurely yellow.

Wings hyaline, uniformly enfumed with pale greenish brown, the hind more deeply than the fore and the apices slightly clouded with a darker brown; pterostigma black, narrow; 21 to 24 antenodal nervures and 31 to 33 postnodals to forewings, 18 antenodals and about 26 postnodals to the hind; discoidal cell traversed once in all wings; other venational points as for male.

Abdomen black marked with yellow, the sides of segments 1 to 3 broadly yellow; segments 4 to 7 with a longitudinal lateral stripe expanding basad and extending up towards dorsum so as to form incomplete basal rings; segments 8 and 9 with subquadrate apico-lateral spots, 10 unmarked.

Anal appendages short, conical, black. Vulvar scale very robust, yellowish, not extending to end of abdomen.

*Distribution*: Confined, so far as known, to the Palnai plateau, South India. Very few specimens have been collected of this very beautiful, and very local insect. To Mr. Bainbrigg Fletcher belongs the credit of first recognizing this species which, although it had long been in, at least, three collections, had been confused with *dispar*, even by such collectors as Dr. Ris and myself. This on account of its close resemblance to *dispar*, from which however it is easily distinguished when placed side by side. The much greater extent of the opaque area of the hindwing, the ochreous labrum and cheeks (turquoise blue and glossy black respectively in *dispar*), the close approximation of the length of wings to abdomen and the all-red legs are some of the differentiating characters. In addition to these, *cardinalis* has a large triangular tongue-like process springing from the apico-ventral border of the second abdominal segment, which is quite absent in *dispar*.

The female is easily distinguished by its ochreous labrum.

Type in the British Museum, paratypes in the Pusa, Ris, Morton and Fraser collections. The single female known is in the Fraser collection.

Found in numerous sholas, frequenting montane streams of the Palnai Hills from June to October.

*Indophae fraseri* (Laid.) (1920).

*Pseudophaea fraseri* Laid. Rec. Ind. Mus., vol. xxi, pp. 23-27 (1920),—Fras. *ibid.*, vol. xxiv, pp. 8 and 9 (1922),—*Id. ibid.*, vol. xxvi, p. 480 (1924).

Male. Abdomen 36-41 mm. Forewing 34-38 mm. Hindwing 29-35 mm.

Head: labium pale yellow; labrum pale azure blue with its anterior border broadly black, no medio-basal tongue of black; bases of mandibles azure blue, cheeks yellowish white; epistome glossy black; rest of head matt black with occasionally an obscure oval yellow spot on the outer side of each posterior ocellus; eyes dark brown.

Prothorax black with a large pale blue spot on each side of the middle lobe.

Thorax black with antehumeral and humeral stripes on dorsum, the former pale sky-blue in fine contrast to the black ground colour, narrow in its upper half, broadening rapidly in its lower; humeral stripe yellow turning to reddish ochre below, very fine throughout and occasionally broken into several sections. Laterally bright ochreous with reddish tinge posteriorly and marked with a large oval black spot between the humeral and first lateral suture and with the beginning of fine lateral stripes on the upper parts of the two lateral sutures; beneath bright reddish ochreous.

Legs as for *cardinalis* but a brighter red and the anterior pair dark reddish brown, almost black in some.

Wings very similar to *dispar* but the hind very markedly shorter than the fore and evenly rounded at the apices; forewings hyaline with the extreme apex tipped with brown; hindwing with the outer part opaque black with a coppery reflex above and a bluish violet below, this area slightly variable, usually extending from apex to about halfway to the node, less extensive in specimens taken at a low altitude, more extensive in those from a higher; discoidal cell traversed once in the forewings, twice or thrice in the hind; 3 cubital nervures in all wings; *Riii* arising 4 to 5 cells distad of the subnode; pterostigma black, long and narrow covers 8-12 cells; 13-20 antenodal nervures in forewing, and 32-36 postnodals, 15-18 antenodals and 27-30 postnodals in the hind.

Abdomen bright vermilion red to apical end of segment 6, which is clouded with black; segment 7 dark reddish brown to black at apical end; rest of abdomen black. Segment 10 with a prominent carinal spine.

Anal appendages black, very similar to those of *dispar* but with a distinct bend at about their middle; inferiors as for *dispar*.

Genitalia similar to *dispar* but the lobe smaller and bright red instead of matt black.

Female.—Abdomen 33-34 mm. Hindwing 31-33 mm.

Head: labium, labrum, mandibles and cheeks as for male; ante- and post-clypeus glossy black, the latter with a transversely oval blue spot at its centre; frons black, the creamy white of cheeks extending onto it on either side; rest of head black with a small oval greenish yellow spot on the outer side of each posterior ocellus.

Prothorax black with a large oval spot on each side of the middle lobe and the hinder border of the posterior lobe finely greenish yellow.

Thorax black on dorsum, bright yellow on the sides, marked as in the male but the line on the posterior suture rather better defined. In some specimens the antehumeral and humeral stripes are confluent above as a broad loop as in other species of the genus.

Legs yellow, femora blackish on extensor surface, tibiae reddish.

Wings hyaline, palely enfumed, and in many specimens, with the apices of hindwings broadly dark brown to slightly proximal of the outer end of pterostigma in forewings and for a short distance proximal of the inner end in the hind; venational details as for male; discoidal cell traversed once in forewings, twice in the hind or less commonly once; 3 cubital nervures in all wings; pterostigma black, long and narrow, covering 9 to 12 cells; 17 to 18 antenodal nervures and 29-33 postnodals in forewings, 15 to 16 antenodals and 25 to 27 postnodals in the hind.

Abdomen black marked with bright greenish-yellow as follows,—segment 1 broadly so on the sides, the dorsal carina throughout except on segment 1 narrowly, but broadening out on segments 8 to 10, on the latter of which it forms a well-defined spot, the sides of segment 2 broadly, a longitudinal stripe on the sides of segments 3 to 6, broad on 3, becoming progressively finer on the succeeding segments until nearly lost or interrupted on segment 6, apical and basal spots on the sides of 7, a small apical lateral spot on 8 and a very large lateral spot on 9, whilst the sides of 10 are entirely greenish-yellow.

Anal appendages rather longer than segment 10, black, fine, tapering to a fine point. Vulvar scale robust, yellow, not extending to end of abdomen.

*Distribution.* North and South Kanara, Malabar, Coorg and the Nilgiri Wynaad. Found on the same rivers as *dispar* but at a lower elevation, thus in Malabar it occurs sparingly near sea-level. In Coorg and the Nilgiri and Malabar-Wynad it occurs up to 3,500 ft. from May to August.

Type in the Indian Museum, paratypes in Pusa and British Museums and in several private collections, Morton, Williamson, Laidlaw, Inglis and the authors. The males are not uncommonly seen resting with their wings well open as in genus *Lestes* and are usually found on low herbage along the banks of their parent streams. Females are not uncommon in the neighbouring jungle, settled on twigs at about 8 to 12 feet from the ground.

#### Subfamily PHILOGANGINAE Kennedy (1920).

*Philoganginae* Kennedy, Ohio Journ. Sci. vol. xxi, No. 1. p. 23. figs. 38-39 (1920).

Robust insects with general facies of both sexes resembling somewhat that of Epallagine females, but details of venation, etc., differing rather widely from that subfamily.

Fore-and hind-wings of similar shape and similar in both sexes, very long and very narrow, petiolated to nearly as far as level of arc; node at about two-fifths of the wing length from base; discoidal cell entire, short, about one-fifth to one-sixth the length of median space, its costal side slightly shorter than posterior, its distal end oblique; *Ri* not in contact with *Rii*; *Riii* arising at, or 1 to 2 cells distad of subnode; arc slightly bent, situated at and in line with the distal primary antenodal nervure; antenodal nervures moderately numerous, those in subcostal space more numerous than those in the costal and, except for the two primary antenodals, not coinciding with them; 1 to 4 basal incomplete or subcostal antenodals, usually 2 or 3; and always a single subcostal antenodal between the two primaries; no cubital nervures beyond the nervure *ac* in all wings, *ac* lying much nearer the distal primary antenodal or midway between the primaries; petiolation marked, ending at a point opposite to or slightly proximad of *ac*; *1A* straight, slightly concave or markedly convex, 1 to 2 rows of cells between it and posterior margin of wing, ending on wing margin opposite to or widely distad of node; 1 to 2 well defined oblique nervures between *Rii* and *IRii*; intercalated nervures between *Riv* + *v* and *I Riii*, *I Riii* and *Riii*, *Riii* and *Rii*; pterostigma present in all wings of both sexes, long and narrow.

Head robust, Gomphine-shaped; eyes rounded, tumid behind, rather widely separated from one another; labium with middle lobe deeply cleft, ends of lobes acute; labrum arched at free border.

Thorax very robust, short; legs long and slim; femora with 2 rows of very short, very closely-set, evenly-sized spines with more robust ones set at longer but even intervals; tibial spines moderately numerous but rather short; claw-hooks situated near ends of claws. (Tibiæ in one species with a fringe of hairs in addition to the spines.)

Abdomen robust, cylindrical, slightly dilated at anal end especially in the female, shorter than wings; 10th segment flat on dorsum.

Superior anal appendages of male considerably longer than segment 10, sub-cylindrical, widely separated at base, apices curving in toward one another, blunt, minutely spined at outer border; inferior appendages rudimentary. Superior anal appendages of female long and fine.

Genitalia bearing a close resemblance to that of the *Epallaginae*, especially the anterior hamules and lobe of penis, the former being foliate flattened quadrate processes inclined toward one another, the latter scrotal shaped and rather longer than in the Epallagines; penis closely resembling that of *Amphipteryx*, its tentacles furnished with a fringe of spines at their apex, which is blunt. Vulvar scales very robust, extending well beyond end of abdomen and with the under border of scales coarsely serrate and evidently functioning as a saw for the insertion of ova into plant stems.

*Distribution.* Assam, Bengal, Burma, Indo-China and South China.

I have included the three known species of *Philoganga* under a separate monogeneric subfamily, as their true position is still doubtful, and must remain so until the larva is discovered. From the venation, the extremely long



Photographs by

T. Bainbrigge Fletcher.

Two views of *Philoganga* pool, Shillong. Lower photograph a close-up view of upper. Specimens of *Philoganga montana* were taken resting, with wings outspread, on the bushes overhanging the pool, where the larvæ obviously breed.



A small stream at east end of valley in Shillong, Assam, where *Allophaea ochracea* (Selys) is found. *Disparoneura atkinsoni* Selys also frequents this stream.



Photographs by

T. Bainbrigge Fletcher.

View of the Hatti River, North Coorg. *Indophaea fraseri* (Laid), is not uncommon along the banks of this river, whilst *Dysphaea ethela* Fras., frequents the rocks in midstream. Other species of dragon-fly found here are *Macromia indica*, *bellicosa*, *ida* and *atrata*, and several Gomphines.

petiolation and the fact that they rest with the wings extended flat as in the *Anisoptera*, it is clear that they are archaic insects, probably even more so than *Epiophlebia*. I place them for convenience after the *Epallaginae* because there is a strong resemblance in the genitalia, and the abdominal markings are typical of that subfamily. There however the resemblance ends, as the thoracic pattern, so characteristic of the *Epallaginae*, is quite different to that of *Philoganga* whilst the coinciding costal and subcostal antenodals and the short petiolation of the wings of the *Epallaginae* is quite different to what is found in *Philoganga*. The long petiolation of the wings, the long legs and the shape of the penis seems to show a relationship to *Amphipteryx*, an American genus.

Mr. Bainbrigge Fletcher has taken a number of *P. montana* along the banks of a montane stream in the Khasia Hills, so that it is evident that they breed in such spots. He has taken at least one teneral specimen here, but unfortunately failed to find its exuvia.

#### Genus *Philoganga* Kirby (1890).

*Anisoneura* Selys, Bull. Acad. Belg. (2), vii, p. 444 (1859) and Add. Syn. Cal. p. 10 (1859),—Id. 4th Add. Syn. Cal. p. 33 (1877).

*Philoganga* Kirby, Cat. Odon. p. 111 (1890);—Needham, Proc. U. S. Nat. Mus. vol. 26, p. 755, fig. 44 (1903),—Ris Suppl. Ent. No. 1, pp. 44-47 (1912),—Laid. Rec. Ind. Mus. vol. xiii, p. 33 (1917).

Characters and distribution as for the subfamily *Philoganginae*.

Three species only, *montana*, *vetusta* and *loringæ* of which the former is the geno-type. Only two species taken within Indian limits.

#### *Philoganga montana* (Selys) (1859).

*Anisoneura montana* Selys, Bull. Acad. Belg. (2), vii, p. 445 (1859),—Id. ibid. (2), xlvii, p. 379 (1879).—Kirby, Cat. Odon. p. 111. (1890).

*Philoganga montana* Kirby, l.c. (1890),—Laid. Rec. Ind. Mus. vol. xiii, p. 33 (1917),—Fras. Mem. Pusa, Ent. Ser. vol. viii, No. 8, p. 87, pl. ix, figs. 2-4 (1924).

Male. Abdomen 48 mm. Hindwing 45 mm.

Head: labium yellow, lobes tipped with black, bases of mandibles citron-yellow; labrum glossy black; rest of head matt black with two transverse narrow citron-yellow stripes, one traversing the cheeks and frons, the other running from eye to eye across occiput; behind eyes yellow; eyes brown.

Prothorax black with a longitudinal middorsal stripe bisected narrowly in the middle line of middle lobe and finely interrupted between the middle and posterior lobes.

Thorax black with some pruinescence beneath in adults, marked with greenish and citron-yellow as follows,—a narrow middorsal carinal stripe finely bisected by the middorsal black carina, a small spot on each half of the antealar sinus, a narrow complete humeral stripe, and laterally, two broad oblique stripes, the anterior borders of which are greenish, the first stripe on the mesepimeron, the second covering the entire metepimeron.

Legs black, femora broadly yellow on outer aspect, trochanters each with a large yellow spot; tibiæ of male with a fringe of fine short hairs in addition to the spines.

Wings hyaline; pterostigma blackish brown or paler brown, surmounts  $2\frac{1}{2}$  to  $4\frac{1}{2}$  cells; 2 rows of cells posterior to *IA* this nervure being flat or slightly convex; petiolation ends at *ac* or a little proximal to it in forewings; 2-4 incomplete basal antenodals in forewings, usually 2, 2-3 in the hindwing; nodal index variable,— $\frac{26-12}{18}$  |  $\frac{14}{17-26}$  ;  $\frac{21-10}{15}$  |  $\frac{10}{17-19}$   
 $\frac{24-11}{17}$  |  $\frac{14}{17-24}$  ;  $\frac{17-10}{17}$  |  $\frac{10}{16-17}$

Abdomen black marked with greenish yellow as follows,—segment 1 broadly yellow on the sides and with an apical annule broadly interrupted on the dorsum; segment 2 with a lateral and ventral longitudinal stripe; segments 3 to 7 with a latero-basal transverse spot and a lateral stripe, which on segments 3 and 4 has the apical end expanded, but on 5 to 7 tapers gradually away until much shortened on segment 7; segment 8 with a large triangular latero-apical spot, 9 with a similar but rounded spot, whilst 10 has the apical half yellow.

Anal appendages black; superiors nearly twice as long as segment 10, sub-cylindrical, slender, curving gradually and evenly towards one another, apex

obtuse, the outer border near apex coarsely spined. Inferiors rudimentary, scarcely visible.

Genitalia as for subfamily.

Female. Abdomen 47 mm. Hindwing 52 mm.

Differs only from male in point of size and robust build. Wings occasionally palely yellow towards base; nodal index similar but very variable; only 1 or 2 incomplete basal antenodal nervures to all wings; pterostigma as in male.

Anal appendages long tapering to a fine point, black. Segments 8 and 9 distinctly broadened, almost foliate laterally, segment 9 rather depressed.

Vulvar scale very robust, prolonged well beyond end of abdomen, coarsely serrate beneath.

*Distribution.* Assam and Bengal. Mr. T. Bainbrigge Fletcher has taken this species in moderate numbers during May and June, in two restricted localities bordering montane streams in Shillong. These were resting on bushes with their wings spread horizontally, in which position, from their shape and colouring, they looked very like Gomphines. Mr. Chas. Inglis has taken a male on the banks of a stream below Darjeeling. The type in the MacLachlan collection comes from Assam, and was probably collected by Mr. Atkinson in the same localities in Shillong.

*Philoganga loringae* Fras. (1927).

*Philoganga loringae* Fras. Rec. Ind. Mus. vol. xxix, pp. 79-81 (1927).

Male. Abdomen 41 mm. Hindwing 39 mm.

Head: labium dirty yellow; labrum greenish yellow with a small medio-basal tongue of black; bases of mandibles and cheeks citron yellow for as far up as level of antennæ; rest of head matt black, pruinose in parts; eyes dark brown.

Prothorax black with a middorsal citron-yellow stripe broadening anteriorly and on posterior lobe.

Thorax black marked with citron-yellow as follows,—a moderately broad middorsal stripe finely bisected by the black middorsal carina, a narrow slightly sinuous antehumeral stripe; laterally entirely yellow save for the second lateral suture which is broadly mapped out in black.

Legs long and slim, hind femora extending to middle of segment 2; anterior pair of femora black, the other two pairs dark ochreous; tibiæ and tarsi black; tibiæ not fringed with fine hairs as in *montana*.

Wings hyaline, petiolated to level of *ac* or slightly proximal in forewing; palely and evenly enumed; pterostigma blackish brown covering  $3\frac{1}{2}$  cells; only a single row of cells posterior to *IA*; only 1 cubital nervure to all wings; *Ciii* slightly convex; *IA* a little concave; other details of venation as in *montana* except that the primary antenodals are not as distinct from the others and *Riii* is more distad in its origin, arising from 1 to  $2\frac{1}{2}$  cells distad of the subnode; nodal index,  $\frac{22-13}{17}$ ,  $\frac{13}{19-21}$ ,  $\frac{20-13}{17}$ ;  $\frac{11}{18-19}$ .

Abdomen dark reddish brown; segment 1 greenish yellow, segment 2 with a broad lateral bright yellow stripe narrowly bordered above with black, segment 3 with the black stripe continued but more diffuse and blotting out the ground colour on dorsum of segment, the ventral border dark ochreous, segments 4 to 10 similar but the dorsum entirely black, whilst segment 9 has a duplicate middorsal bright ochreous spot, and 10 two similar, but rounded spots on the dorsum.

Anal appendages black, the superiors nearly twice the length of segment 10 curling gradually in to almost meet at tips, which are slightly dilated and end in obtuse points. On the outer side a few fine spines, much smaller than those seen in *montana*. In profile these appendages are seen to project straight back but the apices slightly upturned. Inferior appendages rudimentary as in *montana*.

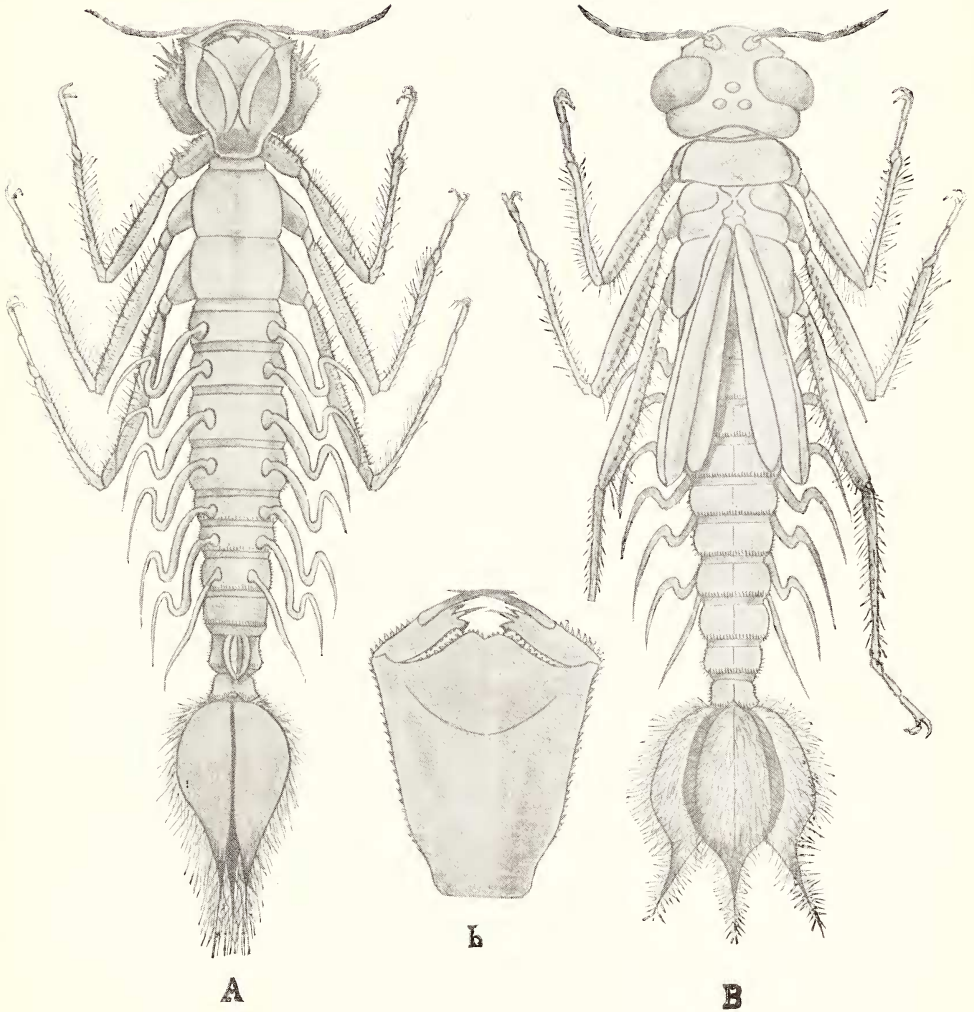
Genitalia: Very similar to that of *montana*. Lobe depressed, moderately long, glossy black, resembling the flattened tumid body of a tick.

Female. Abdomen 42 mm. Hindwing 37 mm.

Very similar in markings to the male but a much larger and more robust insect.

Wings petiolated distinctly proximal to *ac*; 2 basal incomplete antenodals in all wings, occasionally only 1 (2 to 3 in the male); a well defined oblique nervure between *Rii* and *IRii*, sometimes two of such (Usually not very





A. Ventral view of larva of *Pseudophæa splendens* (Selys) female. Note the seven pairs of abdominal gills which are really grappling-irons to anchor the insect to rocks in torrential streams  
B. Dorsal view of larva of *Indophæa fraseri* (Laid). Distinguished from the former by total absence of head spines.  
b. Mask of larva of *Indophæa fraseri* (Laid).

evident in the male); pterostigma rather longer, covering  $4\frac{1}{2}$  cells; nodal index,  $\frac{22-13}{19-17}$ ;  $\frac{13}{19-20}$   
 $\frac{19-12}{16}$ ;  $\frac{11}{15-18}$ .

Abdomen similar to male but sides of segments 9 and 10 broadly ochreous and the dorsal spots replaced by diffuse dark ochreous.

Anal appendages black at tips, brownish yellow from base, short, tapering to a point. Vulvar scale exactly similar to *montana*.

*Distribution*: Maymyo, Upper Burma. Four specimens, 3 males and a single female, the latter in cop. July 1925, collected by Col. F. Wall, I.M.S.

This very rare insect differs from *montana* by its much smaller size, by the labrum yellow instead of glossy black, by the markings of abdomen different and by the point of origin of *Riii*. It and *montana* are at once distinguished from *vetusta* Ris by having only a single row of cells posterior to *IA*. The female has the abdomen rather longer than the wings, the opposite condition being found in *montana*.

#### EPALLAGINE LARVÆ

With the exception of *Anisopleura* and the *Pseudophaea* group we know little about the aquatic life histories of the *Epallagine*.

*Anisopleura* has already been described and figured in Part XXXI of this monograph; of the *Pseudophaea* group we know only the larvæ of *Pseudophaea splendens* Selys (Plate IV, fig. A), *Pseudophaea variegata* (Ramb.), *Indophaea dispar* (Ramb.), and *Indophaea fraseri* (Laid) (Plate IV, figs. B and b.)

The striking difference between these two groups, viz., the total absence of abdominal gills in *Anisopleura* (and probably also in *Bayadera* and *Epallage*), and the presence of seven pairs of these organs in *Pseudophaea* and *Indophaea* tempts one to place these latter genera in a separate subfamily, the *Pseudophiina*. Possibly undue importance has been placed on these structures, which have been called, and said to function as, true respiratory organs. My own observations have led me to the conclusion that their real function is that of anchoring organs, for the larvæ are invariably found clinging to the flat surfaces of stones in the swiftest parts of streams, seemingly by the aid of these seven pairs of grappling hooks, the so-called abdominal gills. Were it not for these organs, they would be instantly swept down stream by the rush of waters as may easily be demonstrated by removing the gills and replacing the dismembered insect on a stone in a swift part of the current. The true legs of course are used for ordinary locomotive purposes, the pseudo legs or gills, having no powers in this respect.

The larvæ of *Pseudophaea splendens*, *Indophaea dispar* and *Indophaea fraseri* are all very similar, the two latter being indistinguishable, except by the locality which they inhabit; the former possessing a lateral beard-like group of robust spines external to and beneath the eyes. The gills are found on the first seven segments and are all S-shaped except the distal pair which are more or less weakly developed.

The caudal gills, as in *Anisopleura*, are triplicate, bladder-like structures, thickly coated with coarse hairs, one situated medially and dorsally, the others lying on each side of it, the apposed surfaces being flattened, the under-surfaces also flattened so as to lie flush with the surface on which the larva is resting. The mask is as shown, simple and without setæ.

(To be continued.)